SILVER HAKE ON THE SCOTIAN SHELF (DIVISIONS 4VWX)

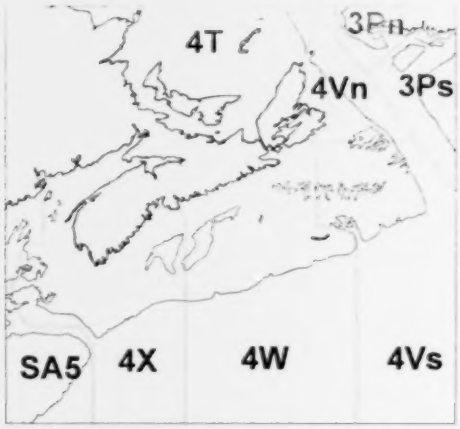

Figure 1. Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX.

Context :

Silver hake (Merluccius bilinearis) is a bottom dwelling member of the gadoid family, found from Cape Hatteras to the Grand Banks and the Gulf of St. Lawrence. A major concentration of silver hake occurs on the Scotian Shelf.

A silver hake fishery has been conducted on the Scotian Shelf (NAFO Divisions 4VWX, Figure 1) since the mid-1960s, primarily by the distant water fleets of Russia, Cuba, and Japan in the early years. Prior to 1977, fishing on the Scotian Shelf was unrestricted in terms of area, mesh size and season.

Since 1995, a fishery has been conducted by the Canadian tonnage class 3 (<65') mobile gear fleet in and around Emerald and LaHave Basins.

An assessment was requested by Fisheries and Aquaculture Management (FAM) Branch to provide harvest advice in support of the 2010/2011 fishery; specifically, to review and evaluate the biological and fishery information on 4VWX silver hake status that would be used as the basis for establishing the total allowable catch (TAC) for the 2010/2011 fishery. An assessment meeting was held 24-26 November 2009. Given problems with the population model, assessment advice was based on survey indices and catch at age.

SUMMARY

- Abundance and biomass have shown a declining trend since 1996, particularly in the case of biomass. Recently 2+ biomass (approximating spawning stock biomass, SSB), since 2002 has been at the lowest levels in the times series (with the exception of 2004).

Canada

- Current relative fishing mortality (F) levels suggest exploitation is moderate relative to the historical period for this fishery. However, Age 1 relative F has been high since 1998, with the exception of 2003-06 (2002-5 year classes).

- The 2007 and 2008 year classes are estimated to be near average in abundance.

- Total mortality (Z) for ages 2-4 declined from 1999 to 2003, but has increased since. Z for Age 1 fish was stable from 1986 to 2001, but has increased sharply in recent years.

- Condition shows a general decline from 1975 to 2002, but subsequently has improved, and is now near the long term average for the time series

- Length at age for ages 2, 3, and 4 have shown declines since the 1970s, but have been stable since 1995, although they still remain below the long-term mean.

- Since 1999, changes have been seen in the catch at age in the commercial fishery, with Age 1 and 2 fish now an important component of the catch compared to previous decades. The high proportion of young ages currently being harvested may be preventing this stock from rebuilding.

INTRODUCTION

Biology

Scotian Shelf silver hake are generally found between 7 and 10° C, in deeper water on the shelf edge and in the Emerald and LaHave basins. Seasonal movements occur during the summer, as silver hake move into shallow water on Sable and Western banks, with the majority of spawning occurring in August. Scotian Shelf silver hake feed primarily on invertebrates, with krill the predominant prey item. Older fish (5+) are piscivorous, and they exhibit a high degree of cannibalism with smaller silver hake making up as much as 20% of their diet depending on recruiting year class size.

Silver hake exhibit relatively rapid growth with females growing faster than males. Maximum age is 12 years. Maturity is relatively early, with a majority maturing at Age 2.

Rationale for Assessment

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Specific objectives were:

- Report on the current status of 4VWX silver hake based on the latest information from fisheries and research surveys, and characterize the uncertainty of results.

- Evaluate the potential consequences of different harvest levels during the 2010/2011 fishery on stock abundance and exploitation rate.

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The Fishery

TAC and landings have been relatively low since 1994. The TAC in 2009 was 15,000t (Table 1, Figure 2). Landings in the fishery from 1 April through 20 November 2009 are 7,440t. While for many years the silver hake fishery was concentrated on the shelf edge by foreign vessels, since 1997 the majority of catches have been taken by Canadian vessels in Emerald and LaHave basins.

Table 1. Landings of silver hake in 4VWX (000s t).

Year	1970-79	1980-89	1990-99[2]	2000[3]	2001	2002	2003	2004	2003	2004	2005	2006	2007	2008	2009
TAC	90.2[4]	98.5	53.3	20	20	20	15	15	15	15	15	15	15	15	15
Canada[1]	0	0	3.7	12.9	18.0	16.7	12.8	12.9	12.8	12.9	11.8	12.8	12.3	12.1	
Foreign	115.6	64.2	27.8	0	0	0	.0	0	0	0	0	0	0	0	
Total	115.6	64.2	31.5	12.9	18.0	16.7	12.8	12.9	12.8	12.9	11.8	12.8	12.3	12.1	

1. Includes developmental allocations fished by foreign flagged vessels, ending in 2004.
2. Fishing year, landings and TAC refer to the 15-month period from January 1, 1999 to March 31, 2000.
3. Commencing in 2000, fishing year, landings and TAC refer to the period from April 1st of the current year to March 31st of the following year.
4. Average TAC for 1974-79 period.

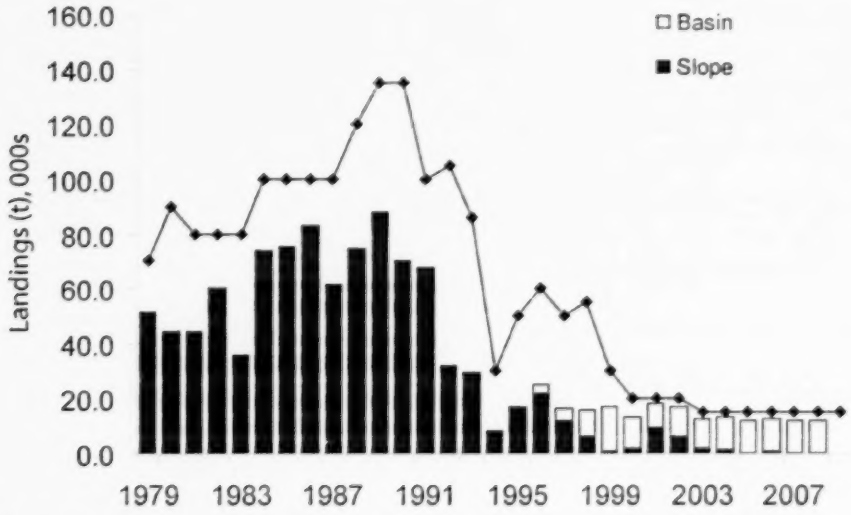

Figure 2. Recent landings and TAC for Scotian Shelf silver hake.

Since 1999 the catch composition of the silver hake fishery has shifted from primarily ages 3 and 4 to younger fish, and the proportion of ages 1 and 2 in the catch is relatively high (Figure 3).

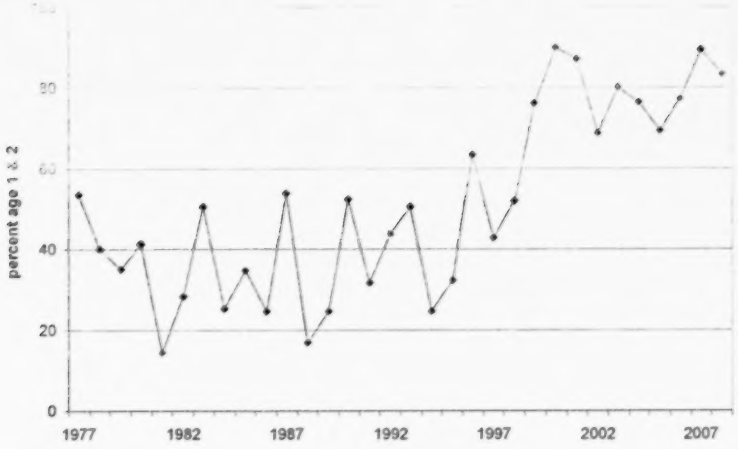

Figure 3. Silver hake catch numbers at ages 1 and 2 as a proportion of the total catch

RESOURCE ASSESSMENT

Stock Trends and Current Status

DFO **summer research vessel (RV) survey** trends in both numbers and biomass show relatively high levels in the early to mid-1980s, followed by a decline to relatively low levels over the period 1988-94 (Figure 4). Abundance and biomass increased in 1995 and 1996, but they have shown a declining trend subsequently, particularly in the case of biomass.

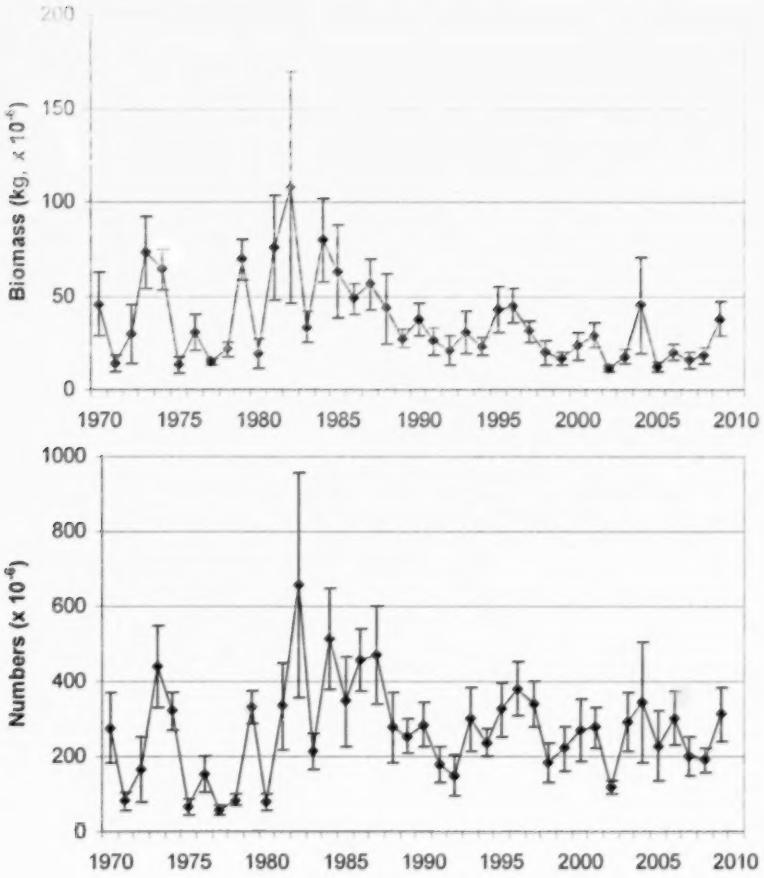

Figure 4. Silver hake biomass (top) and abundance (bottom) estimates from the summer RV survey, 1970-2009 for Scotian Shelf strata 440-483 (excludes Bay of Fundy). Years 1970-81 corrected for survey vessel effect (error bars and units).

Silver hake 2+ biomass, approximating spawning stock biomass (SSB), may have increased in 2006-8, but since 2002 has been near the lowest levels in the times series with the exception of 2004 (Figure 5).

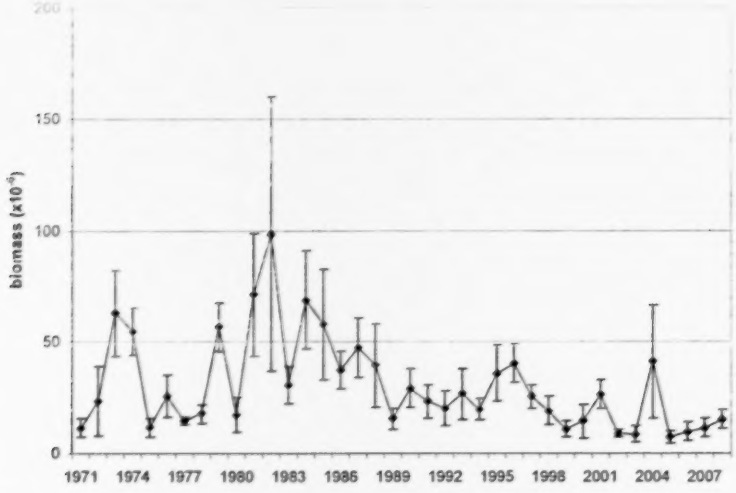

Figure 5. Silver hake age 2+ biomass from summer RV survey, 1971-2008.

Recruitment has been variable. The 2002, 2004, and 2005 year classes were large. However, recruitment to the 2009/2010 fishery is from the 2006-8 year classes, which are near average in abundance (Figure 6).

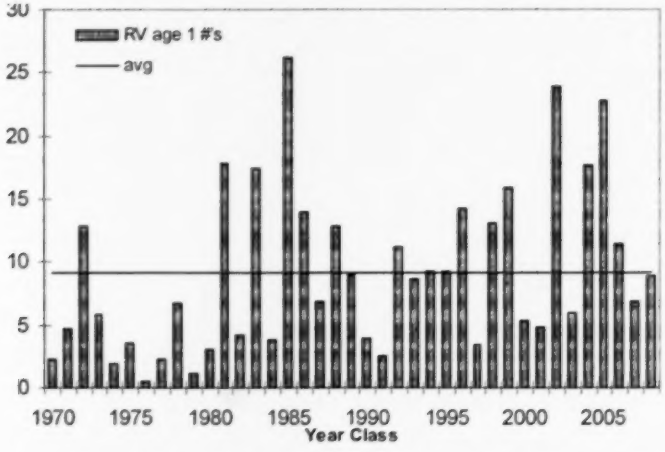

Figure 6. Recruitment estimates for Scotian Shelf silver hake from Age 1 summer RV survey abundance (2008 point estimated from length data).

There are currently no reliable estimates of fishing mortality (F). However, **relative F** can be calculated as the ratio of the commercial catch to the minimum trawlable biomass from the summer RV survey. Relative F was very high during the 1970s and high during the mid-1980s and early 1990s. Current relative F levels are considerably lower, suggesting exploitation is moderate relative to the historical period (Figure 7).

Figure 7. Relative F for Scotian Shelf silver hake from summer RV survey biomass and commercial catch weight.

However, relative F on Age 1 fish has been high since 1998, with the exception of 2003-06 (2002-5 year classes) (Figure 8). Three of these years had high levels of recruitment.

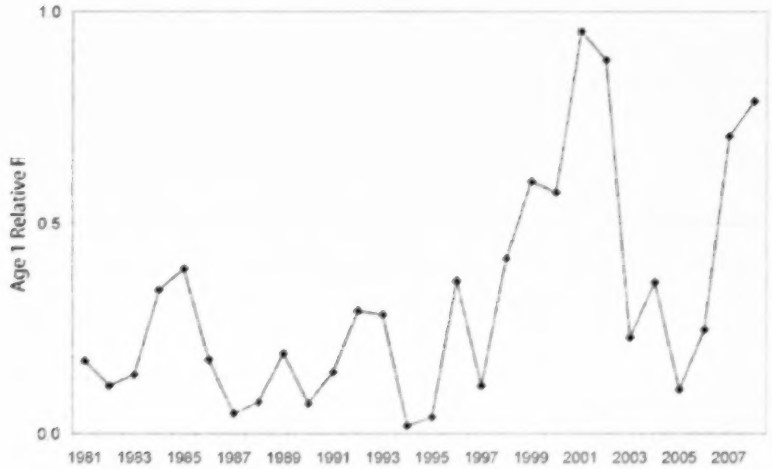

Figure 8. Relative F for Age 1 Scotian Shelf silver hake from the summer RV survey numbers and commercial catch numbers.

Total mortality (Z) on ages 2-4 fish (i.e., the age classes on which the fishery traditionally has been conducted) was high from 1996 to 1998, despite a sharp decline in catches. Z for this age group declined from 1999 to 2003 but has increased since. Total mortality for the oldest ages shows a similar pattern. Z for Age 1 fish was stable from 1986 to 2001, but has increased sharply in recent years (Figure 9).

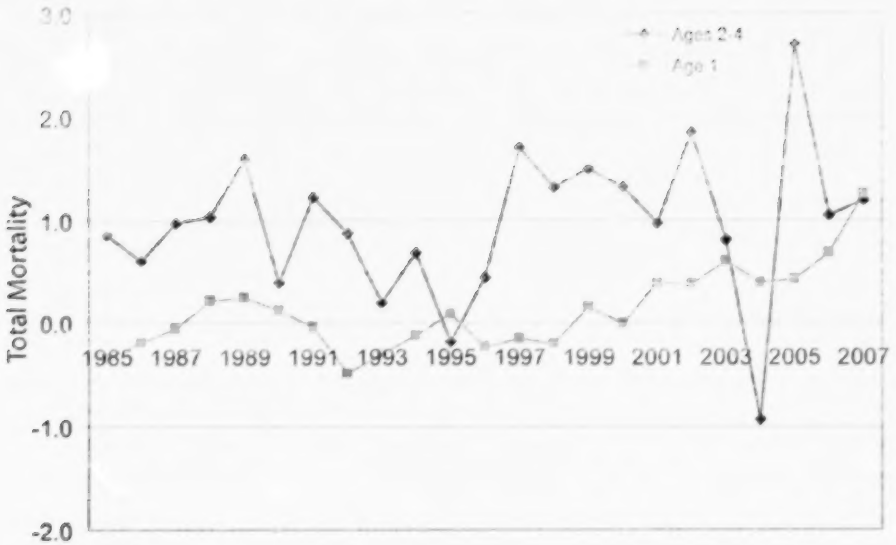

Figure 9. Estimates of total mortality for Ages 1-4 Scotian Shelf silver hake, from the summer RV survey numbers.

Condition (weight at 25cm), shows a general decline from 1975 to 2002. However, since 2002 condition has improved, and it is now near the long term average for the time series. (Figure 10).

Figure 10. Condition factor (predicted weight at 25cm) for Scotian Shelf silver hake from the summer RV survey data (dotted line is average for the time series).

Length at age for ages 2, 3, and 4 have shown declines, from relatively high levels in the mid 1970s to a low in 1995. Length at age for these ages have been stable since 1995, although they still remain below the long-term mean (Figure 11).

Figure 11. Mean length at age for Scotian Shelf silver hake from summer RV survey data.

ECOSYSTEM CONSIDERATIONS

Bycatch

Although a small mesh fishery, the Scotian Shelf silver hake activity is restricted to deeper water, in the inshore basins or off the edge of the shelf, which limits bycatch. In addition, a separator grate that restricts the catch of larger fish is mandatory.

Observer coverage for this fishery in recent years has ranged between 5 and 10%. Based on Observer records, bycatch in this fishery is very limited, with less than 4% of the total catch being non-directed. Red hake, herring and dogfish are the most common bycatch species, at 0.9, 0.8 and 0.4% respectively. Other species of possible concern are a rare bycatch, such as basking shark (0.1%) and pilot whales (0.02%).

Sources of Uncertainty

As an acceptable population model is not available at this time, absolute estimates of population size and exploitation rates cannot be calculated. Consequently, limit reference points for F and SSB are not available and consequences of different harvest levels cannot be evaluated.

Further investigation of conversion factors between various research vessels used to conduct the summer RV survey is required.

Increases in the commercial catches of Age 1 fish may be related to the geographical distribution, vertical distribution, gear selectivity, or seasonality of the fishery.

CONCLUSIONS

Landings have been maintained at a low level since 2000, with most catches occurring in the basins since 2005. There is an increasing proportion of young fish (age 1 and 2) in the catch.

Survey biomass remains at or near the lowest in the times series, though there has been a slight increase in the mean over the past few years. Growth at present is poor, with length at age below the long-term average. However, some improvement has been seen in seen in

condition and weight at age. While several large year classes were seen between 2003 and 2005, recruitment in 2006-8 was only average.

Relative F on Age 1 fish has been high since 1998, with the exception of 2003-6 (2002-5 year classes).

Total mortality on ages 2-4 and older fish has been variable, but Z on Age 1 fish has increased in recent years.

Since the 2005 assessment, there have been slight improvements in SSB and condition. However, the high proportion of young silver hake currently being harvested are of concern. It is recommended that efforts be made to reduce exploitation on these ages, as the high proportion of young ages currently being harvested may be preventing this stock from rebuilding. As an acceptable population model is not available at this time, absolute estimates of population size and exploitation rates cannot be calculated. Consequently, limit reference points for F and SSB are not available and consequences of different harvest levels cannot be evaluated.

FOR MORE INFORMATION

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